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## Engineering Design File

PROJECT NO. 23833

# OU 7-13/14 In Situ Grouting Project Support Vehicles

Idaho National Engineering and Environmental Laboratory

Form 412.14
10/9/2003
Rev. 05

EDF No.: 5162 EDF Rev. No.: 0 Project File No.: 23833

1. Title: OU 7-13/14 In Situ Grouting Project Support Vehicles

2. Index Codes:
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3. NPH Performance Category: _____ or ☒ N/A

4. EDF Safety Category: _____ or ☒ N/A SCC Safety Category: Consumer Grade or ☒ N/A

5. **Purpose:** This engineering design file provides conceptual design information for support vehicles for in situ grouting of select areas of the Subsurface Disposal Area at the Idaho National Engineering and Environmental Laboratory's Radioactive Waste Management Complex for the Operable Unit 7-13/14 Phase 2 In Situ Grouting Project.

**Scope:** This engineering design file prepares conceptual design information for general project support vehicles for in situ grouting of selected areas of the Subsurface Disposal Area for the purpose of enabling the following follow-on preparation by others:

- Conceptual design cost estimate for project documentation
- Hazards analysis for project documentation
- Environmental assessment for project documentation
- Procurement Performance Statement of Work for inclusion in a future performance-based Request for Proposal.

**Conclusions:** Several types and quantities of support vehicles have been identified for the Phase 2 In Situ Grouting Project. From a contamination control standpoint, the project may wish to minimize the numbers of support vehicles within the fenced area of the Subsurface Disposal Area.
However, from a project execution standpoint, insufficient types and numbers of support vehicles could have a negative impact on the ability to perform the tasks according to the requested schedule. The project will face additional contamination and radiological control risks if too many vehicles are onsite. Contractors will generally not have contamination control experience. Logistics for additional support vehicles, although necessary for execution of the project, may result in unforeseen radiological control oversight problems.

**Recommendations:** This conceptual design recommends the allowance for use of rented, used, or new support equipment based on vendor desires. This allowance should provide a means for potential bidders to reduce their overall financial risk. The project should include, wherever possible, support vehicles that can be used for multiple duties to provide the functional capability to the project while minimizing the numbers of vehicles onsite. Also, future procurements should recognize the potential contamination control issues with increased numbers of equipment onsite and request an optimization study as a deliverable within a procurement action.

6. Review (R) and Approval (A) and Acceptance (Ac) Signatures:
(See instructions for definitions of terms and significance of signatures.)

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EDF No.: 5162 EDF Rev. No.: 0 Project File No.: 23833

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|---|---|---|---|---|
| 1. | Title: | OU 7-13/14 In Situ Grouting Project Support Vehicles | | |
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| 13. | Registered Professional Engineer's Stamp (if required) | | | |

# CONTENTS



# TABLES

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# ACRONYMS

| | |
|---|---|
| DOE | Department of Energy |
| EDF | engineering design file |
| FY | fiscal year |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| ISG | in situ grouting |
| MCP | management control procedure |
| RWMC | Radioactive Waste Management Complex |
| SAR | safety analysis report |
| SDA | Subsurface Disposal Area |
| TFR | technical and functional requirements |

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# OU 7-13/14 In Situ Grouting Project Support Vehicles

## 1. PURPOSE

This engineering design file (EDF) provides conceptual design information for support vehicles for in situ grouting (ISG) of select areas of the Subsurface Disposal Area (SDA) at the Idaho National Engineering and Environmental Laboratory's (INEEL's) Radioactive Waste Management Complex (RWMC) for the Operable Unit 7-13/14 Phase 2 ISG Project.

## 2. BACKGROUND

The INEEL is a U.S. Department of Energy (DOE) National Laboratory located approximately 50 miles from Idaho Falls, Idaho. Several discrete disposal locations in soil vault rows, pits, and trenches within the SDA will be remediated by single fluid nondisplacement ISG over a span of several years. Chemically and radiologically contaminated soil and debris may be encountered during remedial activities. The SDA consists of a fenced area of approximately 97 acres that contains 20 pits, 58 trenches, and 21 soil vault rows. The depth of the area from surface to bedrock varies from approximately 15 to 30 ft. Vertical sections of the area contain waste zones consisting of underburden soil, waste burial zones, and overburden soil, as well as native soil between the disposal areas.

The current envisioned project is to inject cementitious grout into the subsurface to approximate maximum depths of 25 ft, forming monolithic columnar blocks or spaced vertical support columns. Originally, pits and trenches were typically constructed by excavating undisturbed earth to bedrock (i.e., 15 to 25 ft) and backfilling the excavation with several feet of clean fill in order to create a disposal volume. This volume would then be filled with various types of wastes. Typical wastes would include 55-gal waste drums, large wooden waste boxes, and construction and demolition wastes. Some nontypical wastes may also be included in some waste volumes. After the disposal volumes were filled, an additional layer of clean fill would be added to close the volume. Additional soil cover has been added since the initial closure to fill subsidence areas and provide drainage contouring. Soil vaults are unlined and were normally constructed using 6-ft augurs. Waste was placed in the vaults, which were then closed with a soil cover.

Pits and trenches within the SDA at RWMC that contain low-level waste will be grouted to form a monolith totally encapsulating the waste. Transuranic waste pits and selected trench areas will be grouted with wider spaced columns, sufficient to support a cap in the future.

The low-level waste under consideration lies beneath an area of about 11.1 acres and occupies a volume of about 1,320,000 $ft^3$. The transuranic waste pits and trenches are spread over an area of 15.4 acres and occupy a volume of about 2,330,000 $ft^3$.

## 3. SCOPE

This EDF prepares conceptual design information for general project support vehicles for the ISG of selected areas of the SDA to enable the following follow-on preparation by others:

- Conceptual design cost estimate for project documentation

- Hazards analysis for project documentation
- Environmental assessment for project documentation
- Procurement Performance Statement of Work for inclusion in a future performance-based Request for Proposal.

# 4. REQUIREMENTS

Requirements for the Phase 2 ISG Project are identified by two types of bases. These include technical and functional requirements (TFR) as described in TFR-267, "Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System)," and additional design criteria as identified in this EDF.

Technical and functional requirements are developed for a project before the conceptual design process by project staff and approved by the project engineer. TFR-267 was developed as high-level requirements for the ISG Project. During the conceptual design process, the TFRs are reviewed and investigated by the conceptual design engineers. The conceptual design approach is then developed from the investigation and analysis of these customer requirements and the conceptual design is then created. The engineer then develops and specifies design criteria unique to the individual subsystem for the subsequent detailed design.

Table 1 identifies applicable requirements as defined in TFR-267. Additional design features are listed as salient features under the system design discussion.

Table 1. Technical and functional requirements defined requirements.

| TFR | Paragraph | Requirement | Note |
|---|---|---|---|
| 267 | 3.3 | System shall operate under the DOE Nuclear Safety Requirements established in 10 Code of Federal Regulations 830 Subpart B, "Safety Basis Requirements," and the implementing DOE orders and contractor Program Requirements Documents and Management Control Procedures (MCPs). This shall be documented in an addendum to the RWMC Safety Analysis Report (SAR)-4 addressing this project. | |
| 267 | 3.3 | The ISG Project shall be conducted as a Comprehensive Environmental Response, Compensation, and Liability Act Section 104 non-time-critical removal action. | |
| 267 | 3.3 | System shall be designed under the applicable radiological work permit. This shall include requirements for portable personnel airborne monitoring equipment, portable personnel exposure monitoring equipment, and portable personnel contamination control equipment. | |

Table 1. (continued).

| TFR | Paragraph | Requirement | Note |
|---|---|---|---|
| 267 | | Mechanical components shall be capable of meeting specified performance at an elevation of 5,000 ft above sea level. | |
| | | The system shall include features in the design to facilitate deactivation, decontamination, and decommissioning of all components and equipment. | |
| 267 | | Electrical components shall be capable of meeting specified performance at an elevation of 5,000 ft above sea level. | |
| 267 | | System shall maintain components in a stable and known condition from the annual lay-up period until the next year startup. | |
| | | System shall maintain components in a stable and known condition from the after-shutdown until the post-shutdown lay-up period. | |
| | | System shall maintain components in a stable and known condition from the post-shutdown lay-up period until deactivation, decontamination, and decommissioning. | |
| 267 | | System shall allow for the regular inspection of major subsystems and components. | |
| 267 | | System shall be designed and constructed as consumer grade per MCP-540, "Documenting the Safety Category of Structures, Systems, and Components." | |
| 267 | | All procured services and materials shall be consumer grade. | |

# 5. APPLICABLE CODES AND STANDARDS

The following conceptual listing of applicable codes and standards relates to implementation of the Phase 2 ISG Project using commercial grade equipment. This listing clarifies, or is in addition to, equipment design codes and standards normally used by a vendor for design and fabrication of equipment:

- Occupational Safety and Health Act regulations
- Factory Mutual.

# 6. SYSTEM CLASSIFICATIONS, CATEGORIZATIONS, AND DETERMINATIONS

All systems and components are commercial grade.

# 7. ASSUMPTIONS

The following are assumptions for support vehicles for the ISG Project:

1. SDA area depths to basalt are provided by the INEEL spatial analysis map, sda_sediment_thickness_dl_v3.mxd.

2. Grouting campaign(s) will begin in Fiscal Year (FY)-2005, and end in FY-2010, with decontamination and decommissioning occurring during FY-2011.

3. Grouting rates are nominally 2.6 $yd^3$/hr, 6.5 hours/day, 7 days/week for FY-2005, and 21 $yd^3$/hr for FY-2006 through FY-2011 (EDF-5135, "OU 7-13/14 In Situ Grouting Project Grout Mixing and Storage").

4. FY-2005 campaigns will use one drill rig/grout pump. FY-2006 through FY-2011 campaigns will use three operating and one spare drill rigs/grout pumps. The out-year mixing plant will be sized to provide enough grout for three drill rigs (EDF-5135).

5. Conceptual design cost uncertainties are ±20%.[a]

6. Trace alpha, beta, and gamma emitting contamination are present within 2 ft of the surface.

7. Nominal waste zone starts 3 ft below surface.

8. Mobile equipment means a wheeled or tracked vehicle, which is engine or motor powered, together with attached or towed equipment. A vehicle operated on fixed rails or tracks is not considered mobile equipment.

9. Soils are characterized as typical of the surrounding geology and include basaltic type soils moderately to heavily consolidated. Typical soil breakdown is approximately 37-wt% quartz, 48-wt% clay minerals, 10-wt% calcite, and 5-wt% minor constituents. The climate is high altitude (i.e., 5000 ft) arid desert.

# 8. SYSTEM DESIGN DISCUSSION

Support vehicles for the ISG Project are itemized in Table 2. General salient features are also presented and include the following:

- Equipment that must operate on SDA waste area surfaces should have ground pressures of 2,000 lb/$ft^2$ or lower. Mats, platforms, or other means to reduce ground pressure should be provided for equipment with ground pressures exceeding this value. During wet conditions or where overburden depths are less than 3 ft, ground pressures should be 1,500 lb/$ft^2$ or lower (EDF-5147, "OU 7-13/14 In Situ Grouting Project Subsurface Disposal Area Site Conditions").

- Systems and operations shall meet Occupational Safety and Health Act standards.

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a. L. Marlar, 6-23-04.

Table 2. In situ grouting Phase II support vehicle.

| Use Area | Vehicle Type | Base Vehicle and Size | Qty FY-05 | Qty FY-06 through FY-11 | Purpose and Features |
|---|---|---|---|---|---|
| Inside fence | Cement ready-mix truck | Cement mix truck, 9-yd$^3$ capacity | 1 | 6 | Transfer grout from fence load point to low-pressure pump receiving bin (FY-2005, 1 truck with 2 cycles of load, transport, clean, FY-2006 through FY-2011, 4 enroute and 2 being cleaned) |
| | Low-pressure pump assembly trailer | 8-ft wide × 40-ft long lowboy tandem axle trailer | 2 | 6 | Contain grout receiving bin(s) and all low-pressure pump components (FY-2005 1 unit operational, FY 2006 through FY-2011 3 units operational, plus one spare per operating unit) |
| | High-pressure pump assembly trailer | 8-ft wide × 40-ft long tandem axle trailer | 2 | 6 | Contain grout all high-pressure pump components (one in use and one spare) |
| | Drill rig lay-down trailer | 8-ft wide × 40-ft long tandem axle flatbed trailer | 1 | 3 | Mobile laydown pad for maintenance and replacement of drill head (one per operating drill rig) |
| | Clean water tank and pump assembly trailer | 8-ft wide × 20-ft long tandem-axle trailer with 500-gal water tank | 1 | 3 | Contain clean water for flushing grouting system components |
| | Vacuum truck (optional) | 1-ton flatbed with grout vacuum hose fan, filters, and collection tank | 1 | 3 | Optional method for removal of potential excess returns from drill string soil interface; vacuum returns to storage tank, transport to disposal location, dump, and rinse system to disposal collection bin or waste water collection tank |
| | Excess returns, excess water tank trailer | 8-ft wide × 40-ft long tandem-axle flatbed trailer with palleted tanks | 1 | 1 | Mobile storage area with 400-gal palleted temporary storage intermediate bulk containers (basis: Phase 1 excess returns resolutions) |

Table 2. (continued).

| Use Area | Vehicle Type | Base Vehicle and Size | Qty FY-05 | Qty FY-06 through FY-11 | Purpose and Features |
|---|---|---|---|---|---|
| | Ready-mix truck cleanout water storage tank and pump assembly trailer | 8-ft wide × 20-ft long tandem-axle trailer with 800-gal water tank | 1 | 3 | Storage tank for cleanup water from rinsing ready-mix truck within the SDA (basis: EDF-5102, "OU 7-13-14 In Situ Grouting Project Grout Delivery System") |
| | Fuel truck | 8-ft wide × 20-ft long twin tank fuel truck | 1 | 1 | Fuel source for equipment inside the fence and diesel and gasoline fuels on powered fuel truck |
| | Bit change box truck | 1-ton flatbed | 2 | 4 | Contain bit change box, equipment, spare bits, and wash tank, (FY-2005, 1 unit operational, FY-2006 through FY-2011, 3 units operational, plus one spare) |
| | Trailer pup | | 7 | 15 | Front axle pintel hitch pup for trailers |
| | Utility truck | 1/2-ton pickup | 1 | 2 | Transport people and small parts |
| | Universal utility trailer tractor | | 1 | 1 | Universal tractor with pintel hitch to move trailers |
| | Rough terrain manlift access platform | Hydraulic 2 manlift, 30-ft reach height capacity | 1 | 2 | Equipment maintenance |
| | Utility front end loader tractor with extendable stick backhoe | 85-hp tractor, 1.25-$yd^3$ bucket, 20-ft extended 3-$ft^3$ bucket, 4-wheel drive | 1 (optional) | 1 | All-purpose project support (basis: Phase 1 resolutions) |
| | Rough terrain extendable forklift | 100-hp, 12,000-lb cap, 20-ft reach | 1 | 1 | All-purpose project support, with bucket, forklift, and man basket attachments (basis: Phase 1 resolutions) |

Table 2. (continued).

| Use Area | Vehicle Type | Base Vehicle and Size | Qty FY-05 | Qty FY-06 through FY-11 | Purpose and Features |
|---|---|---|---|---|---|
| | Radiological controls utility truck | 1 ton | 1 | 1 | Existing radiological controls truck with specialized cargo box |
| Outside fence | Cement ready-mix truck | Cement mix truck, 9-$yd^3$ capacity | 1 | 0 | Transfer grout from offsite location (e.g., Idaho Falls) to load point location at SDA (FY-2005, 2 loads/day, 1 truck at 2 trips per day (load, transport, offload, and clean), FY-2006 through FY-2011, grout mixed onsite and transferred to load point location at fence) |
| | Fuel truck | 8-ft wide × 20-ft long twin tank fuel truck | 1 | 1 | Fuel source for equipment inside the fence and diesel and gasoline fuels on powered fuel truck |
| | Utility truck | 1/2-ton pickup | 1 | 1 | Transport people and small parts |
| | Ready-mix truck cleanout water recirculation storage tank and pump assembly trailer | 8-ft wide × 20-ft long tandem-axle trailer with 1,500-gal water tank | 2 | 3 | Storage tank for cleanup water from ready-mix truck cleanout water storage tank for reuse as grout makeup water (basis: EDF 5102), or temporary storage for alternate disposal. |
| | Universal utility trailer tractor | | 1 | 1 | Universal tractor with pintel hitch to move trailers |
| | Rough terrain extendable forklift | 100-hp, 12,000-lb cap, 20-ft reach | 1 | 1 | All-purpose project and maintenance support, with bucket, forklift, and man basket attachments (basis: Phase 1 resolutions) |
| | Small personnel transports | Small two-person all terrain vehicle transporter | 2 | 3 | Similar to existing RWMC personnel transports |

- Each vehicle shall carry an approved fire extinguisher.
- Safety systems—cab commercial safety interlocks, including flashing lights, audible alert warnings, placarding, and communications system(s).
- Visible flashing light (yellow) to indicate operational status.

## 8.1 Maintenance

Support vehicle equipment maintenance will be performed in the field for minor maintenance, or relocated outside the fence to the maintenance buildings for extensive maintenance. Logistics for radiological controls release of the vehicles outside the fenced area will greatly impact the ability to perform maintenance in the normal maintenance buildings. The project should identify means, such as portable temporary structures, to perform higher-level maintenance tasks inside the fenced area.

## 8.2 Fire Protection

The support vehicles will be commercially available equipment that are used in general industry. At least one 20-lb multipurpose dry chemical fire extinguisher shall be provided on each vehicle. The incorporation of these requirements needs to be evaluated by the fire hazard analysis.

## 8.3 Equipment Condition

The program seeks to maximize performance while minimizing costs. The current direction for project implementation is to release a performance-based Request For Proposal and issue one or more performance contracts. The period of performance is conceptualized from issue of contract through FY-2012 on a nonpriority basis with FY-2005 scoping and remainder scoping. In order to address many of the concerns in a future contract action, a review of some of the issues with the status of equipment used is presented. The issue basically involves the use of new equipment and used equipment. Depending on how the contract is written and what government cost guarantees are included, potential bidders may desire to include used equipment in their plans. The following itemizes some issues and assumptions for use of new or used equipment:

- Use of new equipment will require sufficient initial cash flow to support equipment purchase.
- New equipment should have more state-of-the-art components and systems and provide longer project life.
- The use of used older equipment may provide considerable cost savings to the project or profit potential to the vendor, thereby lessening financial risk. However, used older equipment may be operationally marginal for INEEL standards. For example, used equipment may have minor to significant leaks that would be acceptable for a commercial project, but may be unacceptable for INEEL work base on the quantities of leaking fluids.
- Used newer equipment that has been partially depreciated may provide similar features as new equipment for some potential cost savings.
- Commercial projects generally use equipment from the industrial equipment rental market, this equipment is generally used and in fair to new condition.

Current project projections are for different scope of efforts for the first year of operation (FY-2005) versus out-year efforts. This difference may add complexities to cash flow projections of the potential bidders especially in the early years. Out-year scoping should be of sufficient magnitude to allow efficient operation.

This conceptual design recommends the allowance for use of rented, used, or new support equipment based on vendor desires. This allowance should provide a means for potential bidders to reduce their overall project risk.

## 9. RISKS

Project risks for support equipment generally fall into three categories: safety, loss of equipment, and schedule risk.

Safety risk covers the general operation of the different types of support equipment, and can generally be captured through reviewing the commercial and industrial literature for lessons learned of the different equipment types. This type of risk would be addressed in the project health and safety plan. Appendix B provides a safety tip for rough terrain forklifts that may be applicable to other types of equipment as well.

The second type of risk involves loss of equipment. Since this project entails long duration remediation of radiologically contaminated ground, there is a risk for loss of equipment because of contamination, whereas, the equipment could not be released offsite back to the contractor or rental agency. This type of risk would include financial risk for loss of equipment, as well as disposition liability risk for disposal of the contaminated equipment.

The third type of risk is project schedule risk, and generally includes schedule risk to the project for not providing sufficient support equipment and logistics to enable efficient project execution. Minor project disruptions could result in major schedule delays due to recovery efforts.

## 10. CONCLUSIONS

Several types and quantities of support vehicles have been identified for the Phase 2 ISG Project. From a contamination control standpoint, the project may wish to minimize the numbers of support vehicles within the SDA fenced area. However, from a project execution standpoint, insufficient types and numbers of support vehicles could very well impact the ability to perform the tasks according to the requested schedule.

The project will face additional contamination and radiological control risks if too many vehicles are onsite. Contractors will generally not have contamination control experience. Logistics for additional support vehicles, although necessary for execution of the project, may result in unforeseen radiological control oversight problems.

## 11. RECOMMENDATIONS

This conceptual design recommends the allowance for use of rented, used, or new support equipment based on vendor desires. This allowance should provide a means for potential bidders to reduce their overall financial risk, but may increase schedule risk.

The project should include, wherever possible, support vehicles that can be used for multiple duties to provide the functional capability to the project while minimizing the numbers of vehicles necessary onsite. Also, future procurements should recognize the potential contamination control issues with increased numbers of equipment onsite and request an optimization study as a deliverable within a procurement action.

# 12. REFERENCES

10 CFR 830, Subpart B, "Safety Basis Requirements"

EDF-5102, "OU 7-13-14 In Situ Grouting Project Grout Delivery System"

EDF-5135, "OU 7-13/14 In Situ Grouting Project Grout Mixing and Storage"

EDF-5147, "OU 7-13/14 In Situ Grouting Project Subsurface Disposal Area Site Conditions"

MCP-540, "Documenting the Safety Category of Structures, Systems, and Components"

Mine Safety and Health Administration, http://www.msha.gov/Accident_Prevention/ideas/boom.htm

SAR-4, "Safety Analysis Report for the Radioactive Waste Management Complex"

TFR-267, "Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System)"

Vendor information, Rough Terrain Forklifts, http://www.manitou.com/

# Appendix A

# Vendor Information

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# Appendix A

# Vendor Information

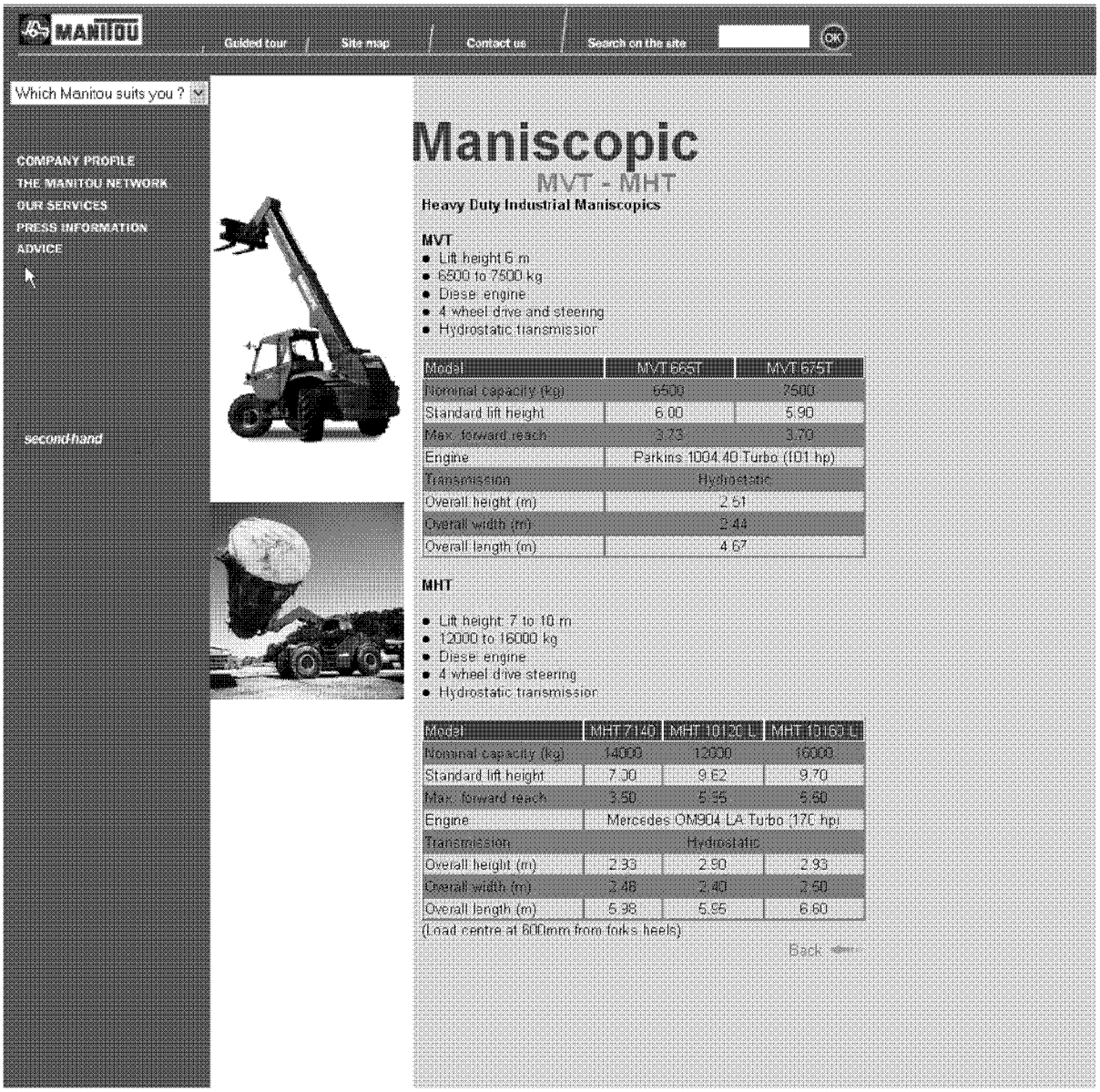


Figure A-1. Manitou equipment (Maniscopic).

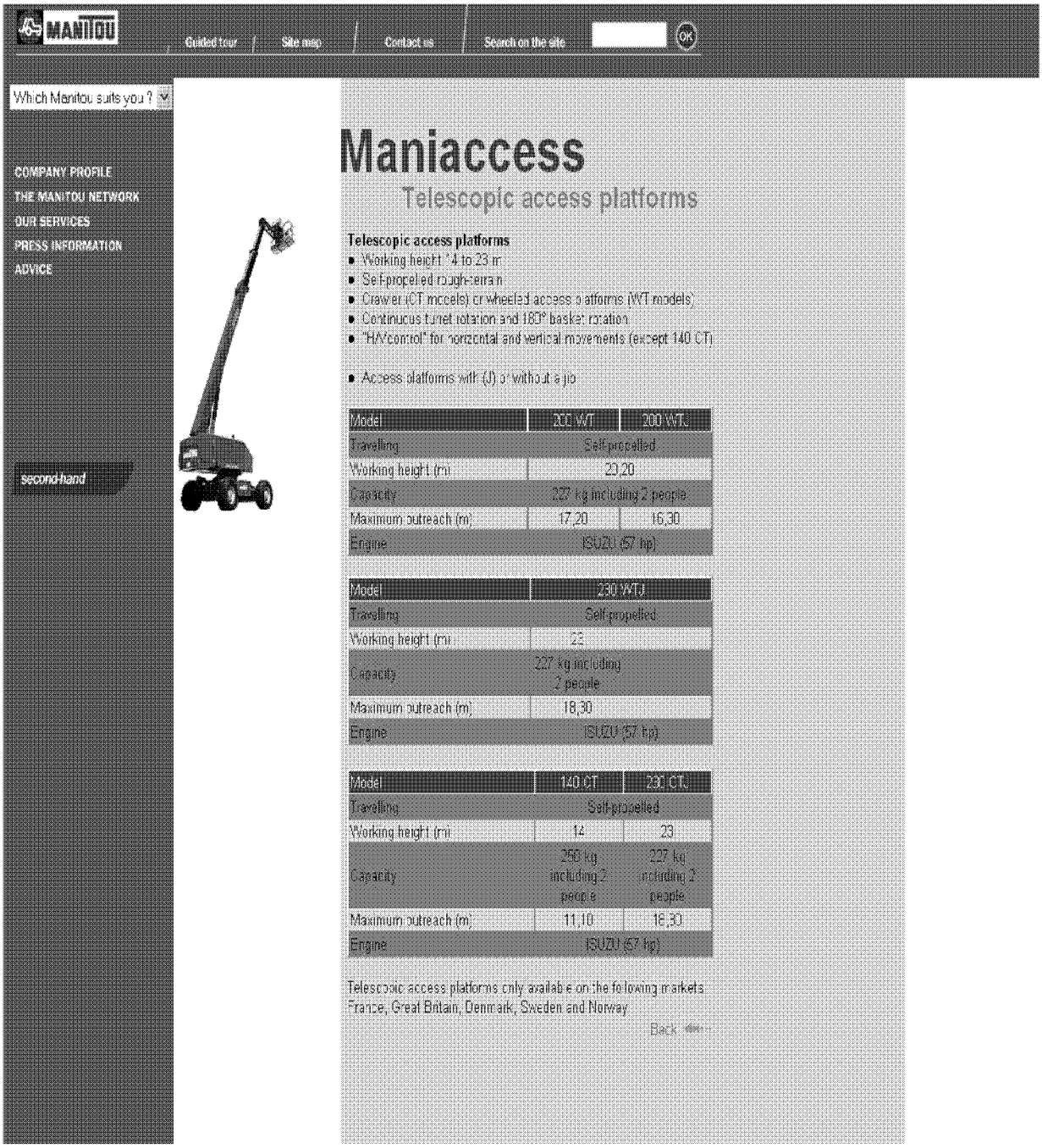


Figure A-2. Manitou equipment (Maniaccess).

MANITOU

news

## Unique Concept: the MANIHOE

March 2004

***Handling or earthworks, why choose ?***

**This patented concept machine, the first of its kind in the world, draws on MANITOU's considerable expertise which has already been put to use on more than 100,000 MANISCOPIC machines. The latest product helps create the first family of MANITOU machines that can cope with both handling and excavating. The name is a contraction of the brand MANITOU and Backhoe, a tractor shovel.**

**HANDLING**
With its front telescopic arm, the MANIHOE can reach forward at heights far exceeding traditional machines. The simple hitching system makes it quick and easy to change attachments without wasting time. Almost all Manitou accessories (forks, buckets, 4 in 1) can be used.

**EARTHMOVING AND EXCAVATION**
The MANIHOE can carry out all the operations normally done by a tractor shovel. The rear-mounted shovel can do all the work of a tractor shovel such as digging trenches, excavation work and drains. The front-mounted telescopic arm makes light of everyday jobs on a construction site:

- Passing over obstacles like trenches, low walls and hedge
- Loading skips
- Laying pipes or cables in the middle of trenches
- Loading trucks from above

The MANIHOE provides two crucial advantages: **extra productivity and ease of use for all tasks.**
Once again, with another brand-new idea, Manitou demonstrates its ability to design a tool that meets its customer's needs.

Figure A-3. Manitou equipment (Manihoe).

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# Appendix B

# MSHA Safety Alert—Rough Terrain Forklifts

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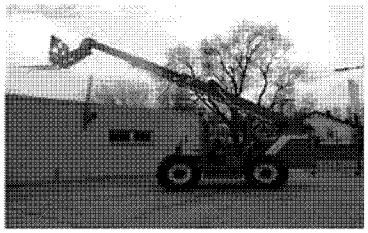
# Appendix B

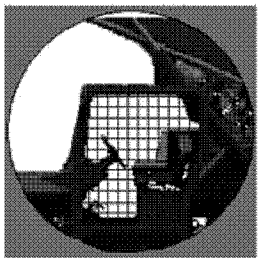
# MSHA Safety Alert—Rough Terrain Forklifts


Recently, a miner was fatally injured when exiting a rough terrain forklift. The miner set the parking brake and with the engine running, attempted to exit from the right side of the cab under the raised boom. As he was exiting the cab, he became entangled in one of the hydraulic control levers and the boom lowered onto him resulting in crushing injuries.



MSHA suggests barricading the access into pinch point areas similar to these. One method to consider is bolting or welding mesh across the opening on the boom side of the cab. This would prevent anyone from entering or exiting through a hazardous point, and would also prevent the operator from accidently getting his arm or head in a pinch point during operation.

This mesh could be used on continuous mining machines, shuttle cars, crawler excavators and backhoes, or other equipment that has a door on the side of the operator's compartment.



***A Post Script.*** There is another safety concern with these types of machines. When the cabs are provided with windows, it is extremely risky, possibly fatal, to wash the boom side window while under the raised boom. Always lower the boom all the way down, or securely block it before performing any maintenance or repair activities.

| | |
|---|---|
| Reissued: | 04/30/2002 |
| Tag # | AP2002-S038 |

Figure B-1. MSHA safety alert.